

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James Stoffer et al.

Examiner: Vickey Ronesi

Serial No.: 10/758,972

Group Art Unit: 1714

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Docket No.: 2416.003US1

5 Title: CORROSION RESISTANT COATINGS

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10 Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION OF CHARLES J. RAY**

15 I, Charles J. Ray, Ph.D., declare:

I. I have personal knowledge of the following, and, if called to as a witness I could testify thereto.

**BACKGROUND**

20 I am Vice President and Technical Director of Deft Inc. and have been in the employ of Deft Inc. since April 2000.

3. Deft Inc. (Deft) manufactures coatings, including military and commercial coatings, for air and ground transportation. Deft has an exclusive license, for the field of vehicles and industrial metal finishing, with the owner of US Patent Application Ser. No. 10/758,972, the University Of Missouri. I am familiar with this patent application, as well as the development, 25 usages and properties of the claimed corrosion resistant coatings.

4. Deft is presently using the invention, within the scope of the broadest claims of the '972 Application to manufacture non-chromate (Type I, Class N) primers. Specifically, Deft's non-chrome primers contain various Praseodymium oxide compounds in an amount of from about 4.7 wt % to about 13 wt % (wt% based on total weight of solids), and Calcium sulfate in 30 an amount of from about 36.2 wt% to about 55.6 wt% (wt% based on total weight of solids). These primers are intended for use on aircraft, where federal, state, or local regulations restrict the use of chromate compounds. Deft's non-chrome primers have enjoyed a wide degree of

acceptability for military aircraft as they have the necessary characteristics required for military applications.

### **LONG FELT NEED**

5        5. In the coatings industry, non-chromate based coatings for use in aircraft production  
and maintenance operations has long been a goal. Aluminum is the major manufacturing  
material on aircraft structures and components. The processing and maintenance of aluminum  
against degradation and corrosion is of prime importance in preserving aircraft. Historically,  
chromated systems (conversion coatings, primers and hard chromium plated) have been the only  
corrosion inhibitors used on aluminum aircraft. However, it is now known that hexavalent  
10       chromium is carcinogenic and poses significant risk to human health. (U.S. Environmental  
Protection Agency, Chromium Compounds Hazard Summary; U.S. Department of Labor,  
Occupational Safety & Health Administration, Hexavalent Chromium Hazard Recognition).

6. The EPA and OSHA began implementing restrictions on the use of chromates as early  
as the 1970's. The human health risk of chromates in the environment was most notably brought  
15       to the attention of the public in the motion picture Erin Brokovich, which chronicled an  
investigation of hexavalent chromium released into drinking water. The current Occupational  
Safety and Health Administration (OSHA) permissible exposure limit for Hexavalent Chromium  
is 5.0 micrograms per cubic meter as an 8-hour time weighted average. The rule also includes  
provisions for employee protection such as preferred methods for controlling exposure,  
20       respiratory protection, protective work clothing and equipment, hygiene areas and practices,  
medical surveillance, hazard communication, and recordkeeping.

7. Regulatory compliance with new OSHA guidelines has proven difficult, primarily  
because a suitable substitute for chromates as corrosion inhibitors had not been found for many  
years. The difficulty in finding a suitable replacement for chrome coatings has been recognized  
25       in the industry. In particular:

A. *Boeing Environmental Technotes*, August 2004, Vol 9, No. 3, page 3,  
recognized the industry challenge in finding a replacement for chromated primers. A true and  
correct copy of this article is attached as Exhibit A. The article states:

*The search for an environmentally friendly chrome replacement with performance equal to chrome poses a significant challenge to the coatings industry. . . . Multiple non-chrome primers were tested to the requirements of the chromated primers, and the best primers were found to be approximately 80% as good as the chromate control in corrosion protection.*

(Note: The non-chrome primer referred to on page 3 is not Deft's. However, the images of the Chromium and Chromium-free primer (figs 5 and 6) used on page 4 are images of a samples of a Deft non-chrome primer.)

B. *Boeing Environmental Technotes*, December 2006, Vol 11, No. 1, page 1, col. 2, also recognized the industry challenge in finding a replacement for chromated primers. A true and correct copy of this article is attached as Exhibit B. The article states:

*The OSHA proposed rulemaking for Hexavalent Chromium arguably presented one of the most difficult regulatory and technical challenges for Boeing-St. Louis in recent history.*

8. Finding a replacement for chromates in Deft's primer coatings has been difficult. Various chrome free systems were tried, but these systems didn't perform, either showing poor adherence to the aluminum substrate, or inadequate corrosion resistance.

9. The group at the Missouri University of Science and Technology, MS&T (formerly the University of Missouri (UMR)), including the inventors of the '972 Application brought the technology of the '972 Application to Deft for investigation of the use of the inhibitors in our paint and primer formulations. Deft had been looking for a chrome replacement in their primers for a number of years. Rich Albers, Deft's Project Leader in Industrial Water Borne Coatings, and primarily Eric Morris, one of the UMR inventors, now an employee of Deft Inc., investigated the use of rare earth element oxides in Deft's primer system. We found that using a praseodymium oxide in our primer system met or exceeded performance standards, and performed comparably to our chrome containing primers. We entered into a licensing agreement with UMR and began to further develop the non-chrome primers for military aircraft applications.

10. Deft's non-chrome primers have met the following military qualifications:

Deft Product Number	Military Department	Qualification
02GN083	Department of the Navy	MIL-PRF-23377J, (Type I, Class N) primer coatings
02GN084	Department of the Navy	MIL-PRF-23377J, (Type I, Class N), Primer Coatings: Epoxy, High-Solids
44GN098	Department of the Navy	MIL-PRF-85582D, (Type I, Class N), Primer Coatings: Epoxy, Waterborne

In addition, Deft's non-chrome primers are currently being used on the Air Force's fleet of F-15's and F-22's and a Deft non-chrome primer has been approved for use on Apache helicopters.

- 5 These non-chrome primers are compatible with existing equipment used to apply chrome based coatings and they provide the necessary corrosion protection.

11. Deft's non-chrome primers, as claimed, have received awards. In particular, R & D Magazine, awarded Deft an R & D 100 award in 2007. A true and correct copy of the R & D Magazine article announcing this award is attached as Exhibit C. The announcement states:

- 10 *There is a pressing need for environmentally friendly and benign methods and materials to mitigate corrosion on aluminum, especially aircraft. Until recently, chromates were the only corrosion inhibitors used on aluminum aircraft. Unfortunately, chromates are also human carcinogens, but replacing them has been exceedingly difficult. Enter Deft's Benign, Corrosion Inhibiting Aircraft Primers 02GN083,*
- 15 *02GN084, and 44GN098, developed by Eric Morris and Richard Albers at Deft, Inc., Irvine, Calif. and James Stoffer and Thomas O'Keefe at the Univ. of Missouri-Rolla. The corrosion inhibitors used in these new benign aircraft primers are environmentally friendly rare earth compounds.*

12. Deft's non-chrome primers have been recognized by the industry as meeting the long
- 20 felt industry need. In particular:

A. *USAF Materials Technology Highlights*, Spring 2006, p. 2, recognized the effectiveness of Deft's coatings in meeting industry needs. A true and correct copy of the article is provided as Exhibit D. The article states:

During the simulated environment assessments, the coating was found to work just as effectively as a chromate based treatment. . . As a result, F-15 Systems Group has subsequently approved the use of this coating, marking the first fleet of Air Force aircraft using a non-chromated primer coating. . . . Replacing existing chromate containing treatments is expected to eliminate 90 percent of the Air Force's hazardous waste stream and to reduce costs associated with handling and disposal of the current chrome-based treatments, which are carcinogenic.

B. *Air Force Print News Today*, January 18, 2006, recognized the safety and efficacy of Deft's coatings. A true and correct copy of the article is provided as Exhibit E. The article states:

The new non-chromate materials – corrosion inhibiting primers – perform as well as chromate primers, while being safer for the environment and those who work with them, said Mr. Stephens. (quoting John Stephens, aerospace structures engineer, 330<sup>th</sup> Fighter Sustainment Group)

C. *Boeing News*, April 20, 2007, also recognized the effectiveness of Deft's coatings in meeting industry needs. A true and correct copy of the article is provided as Exhibit

F. The article states:

The new primer no longer contains chrome and still gives the Apache the corrosion protection it needs. 'This is great news for the company, our employees and the environment,' . . . The Boeing Company has been searching for an acceptable substitute for the primer for many years and the St. Louis site has been testing materials for more than five years, Patel said. Using research efforts that began in St. Louis, Patel and MP&S engineer Nancy Carlson started evaluation of a promising primer from Deft Coatings, Inc. After many tests inside the lab, Deft's new environmentally friendly primer was chosen.

D. *Boeing News*, December 12, 2007, recognized the effectiveness and environmental friendly feature of Deft's coatings in meeting industry needs. A true and correct copy of the article is provided as Exhibit G. The article states:

5       *The F-22 program has upgraded its primer used for exterior coatings. The new primer, a distinctive blue-green color, costs less, offers greater corrosion protection, and is environmentally friendly.*

(Note: The F-22 is a Lockheed Martin jet and Boeing is a subcontractor to Lockheed using the Deft product. Also, Deft's non-chrome primer used on the F-22 has a unit price that is greater than Deft's strontium pigmented product. Thus, the "costs less" referred to in the article above likely refers to overall costs.)

10       E. *Air Force Print News Today*, February 11, 2008, also recognized the effectiveness and environmental friendly feature of Deft's coatings in meeting industry needs. A true and correct copy of the article is provided as Exhibit H. The article states:

15       *The coating, which protects aircraft painters and the environment from exposure to hazardous materials, was developed through years of research, . . . During the simulated corrosion assessments at Boeing Phantom Works, the coating was found to work just as effectively as the chromate-based coatings that were currently being used.*

13. Accordingly, for many years, in a highly competitive industry, there was a long-felt need and unsupplied want, in the interest of worker safety, as well as the cost and operational  
20       implications of new and pending environmental, and safety and health regulations for an alternative to chrome in coatings applications that met performance requirements in corrosion protection. Because Deft's non-chrome primers address the long felt need and want, address cost, operability, and health and safety standards, and meet or exceed performance standards, Deft's non-chrome primers have enjoyed substantial commercial success since their  
25       introduction and are expected to continue to do so.

### COMMERCIAL SUCCESS

14. Deft began selling non-chrome primers containing organic binders, a praseodymium oxide, and an extender, in a composition that is curable without the addition of heat, according to the broadest claims of the '972 Application in August of 2006.

15. As a result of the advantages of the corrosion inhibiting non coating compositions of the '972 Application, Deft's non-chrome primers (Deft Product Nos. 02GN083, 02GN084, and 44GN098) have been commercially successful since their introduction. Sales are substantial and have been increasing. Our gross sales figures are as follows:

<u>Sales Period</u>	<u>Gross Sales of Deft Non-chrome Primers</u>
August 2006 to December 31, 2006	\$370,947
January 1, 2007 to December 31, 2007	\$843,927
January 1, 2008 to December 31, 2008	Projected at over 1 million

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16. Deft's non-chrome primers will be the only primers being applied to rework F-15 Aircraft and Apache Helicopters, as the final stores of old chromated primer are used. Deft's non-chrome primers are the only primers being applied to new joint strikefighter (F-35) and F-22 Aircraft, and Deft's non-chrome primers are scheduled to begin being applied to new F-15 Aircraft, and Deft's non-chrome primers are scheduled to begin being applied to new F-15 Aircraft in the fall. This is effectively 100% of the current marketshare for new F-35 and F-22 Aircraft, and 100% of the marketshare for future F-15 Aircraft. This attests to the quality and efficacy of the products in a highly competitive market.

17. In my opinion, Deft's commercial success with our non-chrome primers has resulted from the invention claimed in the '972 Application. Prior to discovering the superior performance of using a praseodymium oxide in our primers as a corrosion inhibitor, Deft experimented with many other systems, none of which performed to our satisfaction, either in corrosion inhibiting capability or application. The corrosion inhibitors claimed in the '972 Application which we tested in our primer system overcame the shortcomings that we experienced with other corrosion inhibitors we tested.

18. The commercial success that we have enjoyed in the market with Deft's non-chrome primers is attributable to the advantages of the product, which are imparted by the use of corrosion inhibiting rare earth element oxides and sulfate extenders, particularly praseodymium oxides and calcium sulfate extenders, which are used in Deft's non-chrome primers, 02GN083, 02GN084, and 44GN098. These non-chrome primers have good adhesion to metal substrates, in particular aluminum and aluminum alloys, and they exhibit excellent weathering resistance and

durability when applied to a substrate. Finally, Deft's non-chrome primers more than comply with current chromate environmental standards in that they are chrome free, thus reducing the risk to workers and the cost of environmental clean up.

19. No extensive amount of advertising was conducted for these products. The commercial success enjoyed by Deft's non-chrome primers is an indication that the elements and composition of the claimed corrosion inhibiting compositions attest to its usefulness and are relevant to the non-obviousness of the invention. Deft's compositions have advantages not found in any other non-chrome primer. The superiority of the Deft non-chrome primers has been recognized in the industry (See, e.g., Exhibits C-G), and the superiority of the products is attributable to the commercial success of the products.

I declare that all statements made herein of my own knowledge are true and all statements made on information or belief are believed to be true, and further, that the statements herein were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the application or document or any patent resulting therefrom.

Executed this 10<sup>th</sup> day of September, 2008 at

Irvine, California.

Charles J. Ray  
Charles J. Ray  
Vice President, Technical Director  
Deft Inc.